

WHAT IS CLAIMED IS:

1. A method of preparing foundry sand from particles of a base material, comprising:

shaping the particles through treatment in a controlled energy impactor, said treatment causing the particles to collide with one another such that surface irregularities are chipped away to produce smoothed particles; and

classifying the smoothed particles with an air classifying system to produce at least one grade of finished sand.

2. The method as set forth in claim 1, wherein the base material is a single sand and the step of classifying separates the smoothed particles to provide two grades of the single sand, at least one of which is usable as casting sand.

3. The method as set forth in claim 1, wherein the base material includes at least two mineral components, and the step of classifying separates the smoothed particles into two fractions, each containing a majority of one component.

4. The method as set forth in claim 3, wherein the two components are chromite or zircon sand and another sand respectively.

5. The method as set forth in claim 1, wherein the base material is quartz sand having at least one of chemical and physical characteristics rendering it unsuitable for use as foundry sand.

6. The method as set forth in claim 1, wherein the base material is one of basalt, anorthosite, anorthite, oligoclase, gehlenite, epidote, cordierite and augite.

7. The method as set forth in claim 4, wherein the other sand has a median grain size at least twice that of the chromite or zircon sand and contains less than 10% of particles that are smaller than one and a half times of the mean size of the chromite or zircon sand.

8. The method as set forth in claim 1, further comprising, before the step of shaping, the step of selecting the base material to include two component casting sands, each sand having a different specific gravity such that a median grain size of a first casting sand is at least twice a median grain size of a second casting sand, and wherein the step of classifying separates the smoothed particles into at least the component casting sands.

9. The method as set forth in claim 1, wherein the step of shaping reduces binding residues, present in the base material, to fine particles that are separated out by the air classification.

10. The method as set forth in claim 1 wherein the base material is mixed sand from used molds and cores and wherein the method further comprises, before the step of shaping, the step of crushing the used molds and cores.

11. The method as set forth in claim 10, further comprising, before the step of shaping, the step of treating the base material with a mineral acid solution to facilitate removal of alkaline residues.

12. The method as set forth in claim 5, further comprising, before the step of shaping, the step of treating the sand with a mineral acid solution to facilitate removal of alkaline substances.

13. The method as set forth in claim 11, further comprising, after the step of classifying, the step of adding an acid solution, dissolved in water or alcohol, to the finished sand such that a subsequent dispersion of the finished sand in water elicits a pH of no more than 7.5.

14. The method as set forth in claim 12, further comprising, after the step of classifying, the step of adding an acid solution, dissolved in water or alcohol, to the finished sand such that a subsequent dispersion of the finished sand in water elicits a pH of no more than 7.5.

15. A system for producing and classifying foundry quality sand from a member of the feldspar family, comprising:

a controlled energy attrition unit for oolitizing incoming particulate matter such that oolitized particles are rounded but not crushed; and

a multi-fraction classifier for separating the oolitized particles into at least two grades of foundry sand characterized by containing less than 10% crystalline quartz and having the formula  $XAl_{(1-2)}Si_{(3-2)}O_8$ , where X is selected from the group consisting of sodium, potassium, calcium, iron, magnesium, or a mixture thereof.

16. The system as set forth in claim 15, said multi-fraction classifier comprising:

a vibrating grid for separating an incoming particulate stream;

a classification region divided into at least three chambers, a first chamber yielding an oversize fraction that is

returned to the attrition unit in a recycle loop, and second and third chambers yielding coarser and finer products, respectively;

wherein said products are prepared in said classifier using an air flow of between  $1.0-2.5\text{M}^3\text{sec}^{-1}$  per square meter of chamber cross-section.

17. The system as set forth in claim 16, wherein the first, second and third chambers have lengths of approximately 220mm, 760mm and 850mm, respectively.

18. A system for producing and classifying foundry quality sand from a member of the feldspar family, comprising:

a controlled energy attrition unit for oolitizing incoming particulate matter such that oolitized particles are rounded but not crushed; and

a multi-fraction classifier for separating the oolitized particles into at least two grades of foundry sand characterized by having (i) a particle size distribution where less than 2mass% is smaller than one quarter of a weight average particle size and less than 5mass% is greater than three times the weight average particle size; (ii) a weight average mean particle size of less than 1.5mm and oolitized such that the particles pack well enough to provide a bulk density that is at least 55% of a density of the rock from which they are made; and (iii) an ignition loss of less than 3%.